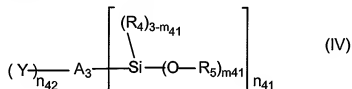


Amendments

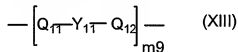
Amendments to the Claims

The present listing replaces all previous listings.

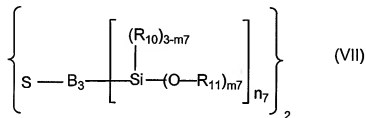
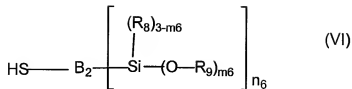
1. (Currently Amended) A proton-exchange membrane having a structure of mesogen-containing organic molecular chains and a proton-donating group-containing group covalent-bonding to a silicon-oxygen three-dimensional crosslinked matrix, in which at least a part of the organic molecular chains are oriented to form an aggregate thereof, and a sulfonic acid sol is used, the sulfonic acid sol being obtained through oxidization of a solution that contains an organosilicon compound of the following formula (IV), and an organosilicon compound of the following formula (VI) and/or (VII):



wherein A₃ represents the following formula (XIII):

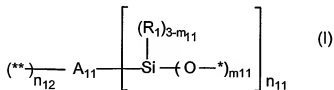


wherein Q₁₁ and Q₁₂ each represent a divalent linking group or a single bond; Y₁₁ is a divalent, 4- to 7-membered ring residue, or a condensed ring residue composed of such rings; and m₉ indicates an integer of from 1 to 3; R₄ represents an alkyl group, an aryl group or a heterocyclic group; R₅ represents a hydrogen atom, an alkyl group, an aryl group or a silyl group; Y represents a polymerizing group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; m₄₁ indicates an integer of from 1 to 3; n₄₁ indicates 1 or 2; n₄₂ indicates 0 or 1; when m₄₁ is 2 or more, R₅ may be the same or different,



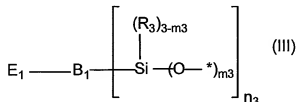
wherein B_2 and B_3 each represent a linking group that contains an aliphatic group and/or an aromatic group; R_8 and R_{10} each represent an alkyl group or an aryl group; $m6$ and $m7$ each indicate a integer of from 1 to 3; $n6$ and $n7$ each indicate an integer from 1 to 4; R_9 and R_{11} each represent a hydrogen atom, an alkyl group, an aryl group or a silyl group; when $m6$ or $m7$ is 2 or more, R_9 or R_{11} may be the same or different.

2. (Withdrawn) The proton-exchange membrane of claim 1, which contains a partial structure of the following formula (I):



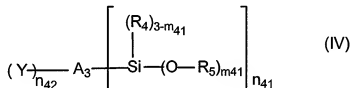
wherein A_{11} represents a mesogen-containing organic atomic group; R_1 represents an alkyl group, an aryl group or a heterocyclic group; $m11$ indicates an integer of from 1 to 3; $n11$ indicates an integer of from 1 to 8; $n12$ indicates an integer of from 0 to 4; * indicates the position at which the structure bonds to a silicon atom; and ** indicates the position at which the structure bonds to an organic polymer chain.

3. (Withdrawn) The proton-exchange membrane of claim 1, wherein the proton-donating group covalent-bonds to the silicon-oxygen three-dimensional crosslinked matrix via a structure of the following formula (III):



wherein B₁ represents a linking group that contains an aliphatic group and/or an aromatic group; R₃ represents an alkyl group or an aryl group; E₁ represents a proton-donating group; m₃ indicates an integer of from 1 to 3; n₃ indicates an integer of from 1 to 4; and * indicates the position at which the structure bonds to a silicon atom.

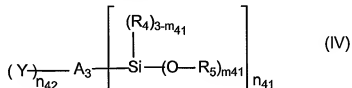
4. (Withdrawn) The proton-exchange membrane of claim 1, which is obtained through sol-gel reaction of a precursor, organosilicon compound of the following formula (IV):



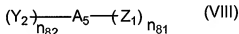
wherein A₃ represents a mesogen-containing organic atomic group; R₄ represents an alkyl group, an aryl group or a heterocyclic group; R₅ represents a hydrogen atom, an alkyl group, an aryl group or a silyl group; Y represents a polymerizing group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; m₄₁ indicates an integer of from 1 to 3; n⁴¹ indicates an integer of from 1 to 8; n⁴² indicates an integer of from 0 to 4; when m₄₁ is 2 or more, R₅'s may be the same or different.

5. (Canceled)

6. (Withdrawn) The proton-exchange membrane of claim 1, which is obtained through sol-gel reaction of a compound of the following formula (IV) with from 1 mol % to 50 mol % of a compound of the following formula (VIII):

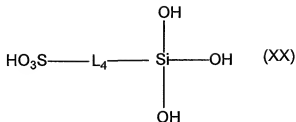


wherein A_3 represents a mesogen-containing organic atomic group; R_4 represents an alkyl group, an aryl group or a heterocyclic group; R_5 represents a hydrogen atom, an alkyl group, an aryl group or a silyl group; Y represents a polymerizing group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; m_{41} indicates an integer of from 1 to 3; n_{41} indicates an integer of from 1 to 8; n_{42} indicates an integer of from 0 to 4; when m_{41} is 2 or more, R_5 's may be the same or different,



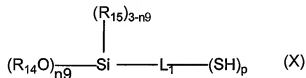
wherein A_5 represents a mesogen-containing organic atomic group; Z_1 represents a substituent not changing in sol-gel reaction, or a hydrogen atom; n_{81} indicates an integer of from 1 to 8; n_{82} indicates an integer of from 0 to 4; Y_2 represents a polymerizing group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; when n_{81} is 2 or more, Z_1 's may be the same or different.

7. (Currently Amended) The proton-exchange membrane of claim 1, in which is used a sol the organosilicon compound of formula (IV) and/or (VI) is obtained through hydrolysis and polycondensation of a precursor of the following formula (XX) in the presence of water and an oxidizing agent:

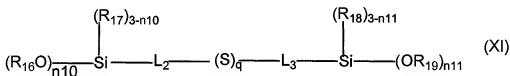


wherein L_4 represents a divalent linking group.

8. (Withdrawn) The proton-exchange membrane of claim 1, in which is used a sol obtained through hydrolysis and polycondensation of a precursor of the following formula (X) and/or (XI) in the presence of water and an oxidizing agent:



wherein L_1 represents a $(p+1)$ -valent linking group; R_{14} and R_{15} each represent an alkyl group or an aryl group; $n9$ indicates 2 or 3; at least one R_{14} is an alkyl or aryl group having at least 3 carbon atoms; R_{14} 's may be the same or different; and p indicates an integer of from 1 to 3,

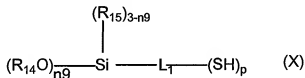


wherein L_2 and L_3 each represent a divalent linking group, R_{16} to R_{19} each represent an alkyl group or an aryl group; $n10$ and $n11$ each indicate 2 or 3; at least one R_{16} and at least one R_{19} each are an alkyl or aryl group having at least 3 carbon atoms; R_{16} 's and R_{19} 's each may be the same or different; and q indicates an integer of from 2 to 4.

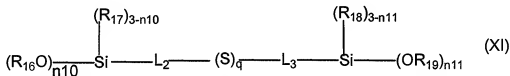
9. (Original) A membrane electrode assembly comprising the proton-exchange membrane of claim 1.

10. (Original) A fuel cell comprising the proton-exchange membrane of claim 1.

11. (Withdrawn) A silica sol composition obtained through hydrolysis and polycondensation of at least one precursor of the following formulae (X) and (XI) in the presence of water and an oxidizing agent:



wherein L_1 represents a $(p+1)$ -valent linking group; R_{14} and R_{15} each represent an alkyl group or an aryl group; $n9$ indicates 2 or 3; at least one R_{14} is an alkyl or aryl group having at least 3 carbon atoms; R_{14} 's may be the same or different; and p indicates an integer of from 1 to 3,



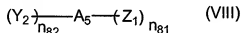
wherein L_2 and L_3 each represent a divalent linking group, R_{16} to R_{19} each represent an alkyl group or an aryl group; $n10$ and $n11$ each indicate 2 or 3; at least one R_{16} and at least one R_{19} each are an alkyl or aryl group having at least 3 carbon atoms; and q indicates an integer of from 2 to 4.

12. (New) The proton-exchange membrane according to Claim 1, wherein Q_{11} and Q_{12} each represent $-CH=CH-$, $-CH=N-$, $-N=N-$, $-N(O)=N-$, $-COO-$, $-COS-$, $-CONH-$, $-COCH_2-$, $-CH_2CH_2-$, $-OCH_2-$, $-CH_2NH-$, $-CH_2-$, $-CO-$, $-O-$, $-S-$, $-NH-$, $-(CH_2)_{(1 \text{ to } 3)}$, $-CH=CH-COO-$, $-CH=CH-CO-$, $-(C\equiv C)_{(1 \text{ to } 3)}$, or their combination, more preferably $-CH_2-$, $-CO-$, $-O-$, $-CH=CH-$, $-CH=N-$, $-N=N-$, or their combination.

13. (New) The proton-exchange membrane according to Claim 1, wherein Y_{11} represent a 6-membered aromatic group, a 4- to 6-membered saturated or unsaturated aliphatic group, a 5- or 6-membered heterocyclic group, or their condensed ring.

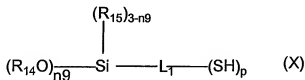
14. (New) The proton-exchange membrane according to Claim 1, wherein B_2 and B_3 each represent $-\text{CH}=\text{CH}-$, $-\text{CH}=\text{N}-$, $-\text{N}=\text{N}-$, $-\text{N}(\text{O})=\text{N}-$, $-\text{COO}-$, $-\text{COS}-$, $-\text{CONH}-$, $-\text{COCH}_2-$, $-\text{CH}_2\text{CH}_2-$, $-\text{OCH}_2-$, $-\text{CH}_2\text{NH}-$, $-\text{CH}_2-$, $-\text{CO}-$, $-\text{O}-$, $-\text{S}-$, $-\text{NH}-$, $-(\text{CH}_2)_{(1 \text{ to } 3)}-$, $-\text{CH}=\text{CH}-\text{COO}-$, $-\text{CH}=\text{CH}-\text{CO}-$, $-(\text{C}\equiv\text{C})_{(1 \text{ to } 3)}-$, or their combination.

15. (New) The proton-exchange membrane of claim 1, which is obtained through sol-gel reaction of the compound of formula (IV) with from 1 mol % to 50 mol % of a compound of the following formula (VIII):

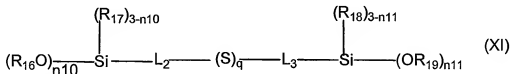


wherein A_5 represents a mesogen-containing organic atomic group; Z_1 represents a substituent not changing in sol-gel reaction, or a hydrogen atom; n_{81} indicates an integer of from 1 to 8; n_{82} indicates an integer of from 0 to 4; Y_2 represents a polymerizing group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; when n_{81} is 2 or more, Z_1 may be the same or different.

16. (New) The proton-exchange membrane of claim 1, in which is used a sol the organosilicon compound of formula (VI) and/or (VII) is obtained through hydrolysis and polycondensation of a precursor of the following formula (X) and/or (XI) in the presence of water and an oxidizing agent:



wherein L_1 represents a $(p+1)$ -valent linking group; R_{14} and R_{15} each represent an alkyl group or an aryl group; n_9 indicates 2 or 3; at least one R_{14} is an alkyl or aryl group having at least 3 carbon atoms; R_{14} 's may be the same or different; and p indicates an integer of from 1 to 3,



wherein L_2 and L_3 each represent a divalent linking group, R_{16} to R_{19} each represent an alkyl group or an aryl group; n_{10} and n_{11} each indicate 2 or 3; at least one R_{16} and at least one R_{19} each are an alkyl or aryl group having at least 3 carbon atoms; R_{16} and R_{19} each may be the same or different; and q indicates an integer of from 2 to 4.